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The College of Arts and Sciences

Announcement of the Department of Chemistry

1921-1922

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COLLEGE OF ARTS AND SCIENCES

COURSE IN CHEMISTRY

The College of Arts and Sciences offers a four-year course leading to the degree of Bachelor of Chemistry. This course is designed primarily to prepare the student for the profession of chemistry, either in the field of teaching or in the chemical industries. It includes adequate instruction in allied subjects, such as Mathematics, Physics, and Engineering, that are usually comprised in courses elsewhere designated "Chemical Engineering." It moreover includes extended instruction not only in the fundamental divisions of chemical science, but also in numerous special branches designed to acquaint the student with the best modern methods of attacking the many varied problems that may arise in the future practice of his profession.

REQUIREMENTS FOR ADMISSION

The entrance requirements of the course leading to the degree of Bachelor of Chemistry will be found on page 12 of the *General Circular of Information* issued by the University.

COURSE OF STUDY LEADING TO THE DEGREE OF BACHELOR OF CHEMISTRY

The degree of Bachelor of Chemistry will be awarded to those who have satisfactorily completed the following curriculum and the requirements prescribed by the University in Hygiene and Preventive Medicine and in Military Drill or in Physical Training.

Students who have not presented three units of German and two units of French upon entering the course in Chemistry, will be required to make up the shortages in these languages before the beginning of the senior year.

CURRICULUM

First Year

		No. of Course	First Term	Second Term
Introductory Inorganic Chemistry	Chemistry	101	6	–
Qualitative Analysis.	Chemistry	205	6 or 0	0 or 6
Analytical Geometry, Differential Calculus, Integral Calculus	Mathematics	7	5	5
Introductory Experimental Physics	Physics	2	–	5
Drawing	Sibley College	D3	3	–
English	English	1	3	3

Second Year

Quantitative Analysis	Chemistry	220	0 or 6	6 or 0
Gas Analysis	Chemistry	250	4 or 0	0 or 4
Introductory Chemical Spectroscopy	Chemistry	505	3 or 0	0 or 3
Introductory Organic Chemistry	Chemistry	305	3	3
Organic Chemistry Laboratory	Chemistry	310	3	3
Light and Heat	Physics	8c	2	–
Physical Experiments	Physics	14	–	2
Introductory Mineralogy	Geology	11	0 or 3	3 or 0
Elective			–	3

Third Year

Advanced Quantitative Analysis	Chemistry	230	2	2
Quantitative Analysis, Lectures	Chemistry	235	–	2
Introductory Physical Chemistry	Chemistry	405	3	3
Physical Chemistry Laboratory	Chemistry	410	3	3
Introductory Chemical Microscopy	Chemistry	530	0 or 2	2 or 0
General Physics	Physics	9c	2	–
Physical Experiments	Physics	14	2	–
Mechanics	Sibley College	M5	5	–
Mechanical Laboratory	Sibley College	X12	–	4
Elective				3

Fourth Year

Introductory Industrial Chemistry	Chemistry	705	3	3
Seminary	Chemistry	905	–	1
Electrical Engineering Laboratory	Sibley College	E12	4	–
Electives		(at least)	5	5
Research for Seniors	Chemistry	—	4	4

Candidates for the degree of Bachelor of Chemistry are required to take at least eight hours in research during the senior year in a division of the Department to be selected by the student. These divisions are: Inorganic Chemistry (Course 195); Physical Chemistry (Course 495); Optical Chemistry (Course 595); Sanitary Chemistry (Course 695); Industrial Chemistry (Course 795); Agricultural Chemistry (Course 895).

The elective courses required in the curriculum may be chosen by the student, in each case with the approval of the Department of Chemistry, from the advanced courses in Chemistry, or from certain courses in other departments of the College of Arts and Sciences or in other colleges of the University.

Students in the Course in Chemistry may register for 20 hours a term. To register for more than 20 hours, the student must first secure the consent of the Department.

Information concerning tuition, fees, living expenses, scholarships, prizes, financial assistance, and opportunities for self-support will be found in the *General Circular of Information*, which may be obtained from the Secretary of Cornell University, Ithaca, N. Y.

INORGANIC CHEMISTRY

101. **Introductory Inorganic Chemistry.** Lectures, recitations, and laboratory practice. Repeated in second term. Credit six hours.

Lectures, first term, three sections, M W F, 9, 10, 11; second term, one section, M W F, 10. *Rockefeller A*. Professor BROWNE, Mr. MCKINNEY, and assistant.

Recitations, one hour a week, to be arranged.

Laboratory, two periods a week; M F, 2–4:30; T Th, 2–4:30; W, 2–4:30 and S, 8–10:30. Professor BROWNE, Mr. MCKINNEY, and assistants.

Entrance credit in chemistry does not carry with it university credit in course 1. If a student entering the University from a preparatory school desires credit in course 1 he must pass an examination set by the Department of Chemistry. This examination is held both in New York City and in Ithaca on the same day in September as the entrance examination. University credit in course 1 that is obtained by passing this examination does not carry with it entrance credit in chemistry.

Examinations for those who were unavoidably absent from the final examination in course 101 will be held at 2 p. m. on the day before instruction begins in the fall.

120. **Introductory Inorganic Chemistry.** For Engineers. Lectures and recitations. First term. Credit four hours. Professor BROWNE, Mr. MCKINNEY, and assistants.

Lectures, M W F, 9, 10, or 11. *Rockefeller A*. Recitation, one hour a week, to be arranged.

125. **Introductory Inorganic Chemistry.** For Engineers. Recitations and laboratory practice. Second term. Credit four hours. Prerequisite course 120. Professor BROWNE, Mr. MCKINNEY, and assistants.

Recitations, two hours a week, to be arranged. Laboratory, two periods a week: M F, 2–4.:30; T Th, 2–4:30; W, 2–4:30 and S, 8–10:30.

130. **Advanced Inorganic Chemistry.** Lectures. Throughout the year. Credit two hours a term. Prerequisite courses 305 and 310, and open to those who have completed or are taking courses 405 and 410. T Th, 11. *Morse 119.* Professor DENNIS and assistant.

Discussion of the chemical elements in the order in which they occur in the Periodic Table of Mendelèeff, with special attention to the group properties of the elements and to the relations of the groups to one another. The rare elements and the rare earths are treated in as great detail as are the more common elements.

135. **Advanced Inorganic Chemistry.** Laboratory practice. Either term. Credit, two, three, or four hours. Prerequisite courses 305 and 310. Professors DENNIS and BROWNE, and assistants.

The study of the preparation, purification, properties, and reactions of inorganic compounds, including those of the rarer elements. Instruction is also given in the elements of glass blowing.

Course 135 is designed to accompany course 130, but either course may be taken separately.

140. **Selected Topics in Advanced Inorganic Chemistry.** Lectures. Second term. Credit two hours. Prerequisite courses 305 and 310. Courses 405 and 410 should precede or accompany this course. T Th, 10. Professor BROWNE.

The lectures deal chiefly with the elements in Group V and Group VI of the Periodic Table.

195. **Research for Seniors.** Throughout the year. See page 5. Professors DENNIS and BROWNE.

ANALYTICAL CHEMISTRY

205. **Introductory Qualitative Analysis.** Lectures and laboratory practice. Repeated in second term. Credit six hours. Prerequisite course 101. Lectures, T Th S, 8. *Rockefeller B.* Laboratory: first term, M W F, 2–4.30; second term, T Th, 1:30–5:15. Mr. RIDER and assistants.

The properties and reactions of the common elements, and of the common inorganic and organic acids; the qualitative analysis of a number of solutions and solid compounds.

Students in science are advised and candidates for the degree of Bachelor of Chemistry are required to take this course instead of course 210.

210. **Introductory Qualitative Analysis. Shorter Course.** Lectures and laboratory practice. Repeated in second term. Credit three hours. Prerequisite course 101. Lecture, T, 12, *Rockefeller A.* Laboratory, T Th, 8–11; T Th, 9–12; M W, 2–5. Mr. RIDER and assistants.

The properties and reactions of the common elements and acids, and their detection in various liquid and solid mixtures.

[215. **Advanced Qualitative Analysis.** Laboratory practice. Repeated in second term. Credit one, two, or three hours. Prerequisite courses 205, 220, 305, and 310. Laboratory sections at hours to be arranged. Mr. RIDER.

Essentially a continuation of course 205. A study of the most approved methods for separating and detecting a number of metals and acids not studied in course 205, including many of the rare elements. In certain cases a comparative study is made of different methods designed to accomplish a given separation. The qualitative analysis of a number of solutions, solid mixtures, and minerals will be required. For graduates and advanced undergraduates.] Not given in 1921–22.

220. **Introductory Quantitative Analysis.** Lectures, recitations, and laboratory practice. Repeated in second term. Credit six hours. Prerequisite course 205. Lectures, T Th, 9. *Morse 119.*

Laboratory sections: First term, M T W, 2–5:30; T Th, 10–1; S, 8–1; second term, W Th F, 2–5:30; T Th, 10–1; S, 8–1. Recitation sections at hours to be arranged. Mr. NICHOLS, Mr. BRANDES, and assistants.

The preparation and standardization of various volumetric solutions and their use in analyzing a variety of substances; gravimetric methods; stoichiometry.

The students in science are advised and candidates for the degree of Bachelor of Chemistry are required to take this course instead of course 225.

225. **Introductory Quantitative Analysis.** Shorter course. Lectures and laboratory practice. Repeated in the second term. Credit three hours. Prerequisite course 210. Lecture, M, 12. Laboratory: first term, Th F, 2–5:30; second term, M T, 2–5:30. Mr. NICHOLS and assistants.

The preparation and use of volumetric solution and work in elementary gravimetric analysis.

230. **Advanced Quantitative Analysis.** Recitations and laboratory practice. Repeated in the second term. Credit two to four hours. Prerequisite course 220. Laboratory sections: first term, M T W, 2–5:30; T Th, 9–1; S, 8–1; second term, W Th F, 2–5:30; T Th, 9–1; S, 8–1. Recitation at hours to be arranged. Mr. NICHOLS, Mr. BRANDES, and assistants.

Gravimetric, volumetric, and electrolytic methods of analysis, and methods of combustion analysis; analysis of iron and steel, alloys, special steels, slags, coal and coke, cement and cement materials, and ores of copper, lead, zinc, mercury, manganese, tin, tungsten, chromium, etc.

235. **Advanced Quantitative Analysis.** Lectures. Second term. Credit two hours. Prerequisite, first term of course 405. M W, 8. *Morse 119.* Mr. BRANDES.

Selected topics in advanced quantitative analysis.

240. **Electrochemical Analysis.** Laboratory practice. Repeated in second term. Credit one or two hours. Prerequisite course 220. Laboratory sections at hours to be arranged. Mr. BRANDES.

A study of the most approved electrochemical methods for the determination of silver, lead, copper, tin, nickel, cobalt, and zinc. Practice will be given in the analysis of alloys and ores.

245. **Assaying.** Lectures and laboratory practice. First term. Credit three hours. Prerequisite courses 210 and 225 or 205 and 220, and if possible a course in mineralogy. Lectures, F, 10. *Morse C.* Laboratory, M W, 2–5. Mr BRANDES and assistant.

Lectures on the theory and practice of the scorification and crucible assay, and on the metallurgy of copper, lead, zinc, silver, and gold. In the laboratory, practice is given in the assay of zinc, lead, copper, gold and silver ores, mattes, and bullion. Designed for students specializing in chemistry and geology and as an elective for students in Mechanical and Civil Engineering.

250. **Introductory Gas Analysis.** Lectures and laboratory practice. Repeated in the second term. Credit four hours. Prerequisite course 205 and Physics 2. Course 250 must be preceded or accompanied by course 220. Lectures, M W, 11. *Morse 119.* Laboratory sections, M T, 2–4:30; W Th, 2–4:30; T Th, 10–12:30; S, 8–1. Mr. NICHOLS and assistants.

The analysis of gas mixtures with various forms of apparatus; the complete analysis of flue gas, coal gas, Pintsch gas, Blau gas, natural gas, producer gas, acetylene, and air; the determination of the heating power of gaseous, liquid, and solid fuels; the analysis of various substances by gas analytical methods involving the use of the different types of gas evolution apparatus. Problems are assigned which afford practice in the calculation and interpretation of results. Within certain limits the work may be selected to suit the requirements of the individual student.

[255 **Advanced Gas Analysis.** Laboratory practice. Second term. Credit one or more hours. Prerequisite course 250. Hours to be arranged. Mr. NICHOLS.

Special topics in the field of either scientific or industrial gas chemistry, varied to suit the needs of the student.] Not given in 1921–19.

295. **Research for Seniors.** Throughout the year. See page 5. Mr. NICHOLS and Mr. BRANDES.

ORGANIC CHEMISTRY

305. **Introductory Organic Chemistry.** Lectures and written reviews. Throughout the year. Credit three hours a term. Prerequisite courses 210 and 225 (or 205 and 220). Open to those who are taking course 220. M W F, 9. *Morse 119.* Professor ORNDORFF, Mr. CORNWELL and assistants.

The lectures discuss systematically the more important compounds of carbon, their occurrence, methods of preparation, reactions, relations, and uses.

310. **Introductory Organic Chemistry.** Laboratory practice and oral reviews. Throughout the year. Credit three hours a term. Open to those who have had or who are taking course 305. Laboratory sections, M T, 1–5:30; F, 1–5:30, S, 8–12:30. Professor ORNDORFF, Mr. CORNWELL, and assistants.

The student prepares a large number of typical compounds of carbon and familiarizes himself with their properties, reactions, and relations. The detection of inorganic elements in organic compounds and the recognition of various groups of radicals is included in the laboratory work.

315. **Special Chapters in Organic Chemistry.** Lectures. Throughout the year. Credit two hours a term. Prerequisite courses 305 and 310. T Th, 9. W. Sibley 1. Professor ORNDORFF and Mr. CORNWELL.

A presentation of certain important chapters of organic chemistry and discussion of selected classical researches in this field.

320. **Advanced Organic Chemistry.** Laboratory practice. Throughout the year. Credit two to six hours a term. Open to those who have had or are taking course 315. Hours to be arranged. The laboratory is open daily. Professor ORNDORFF, Mr. CORNWELL, and assistants.

An advanced course in the preparation of organic compounds. The original literature is consulted, and before taking up original work in this field, the student is required to repeat some extended and important piece of work, and to compare his results with those published.

325. **The Coal Tar Dyestuffs.** Lectures. First term. Credit one hour. Open to those who have had courses 305 and 310 and have had or are taking course 315. F, 11; place to be arranged. Professor ORNDORFF.

Discussion of methods of manufacture of intermediates and dyestuffs and of their properties, constitution, and relationships. The treatment is scientific rather than technical.

330. **The Coal Tar Dyestuffs.** Laboratory practice. Throughout the year. Credit two to four hours a term. Open to those who have had or are taking course 315. Hours to be arranged. Professor ORNDORFF and Mr. CORNWELL.

Preparation of various intermediate products used in the preparation of dyes, and of representatives of the different groups of dyestuffs.

335. **Stereochemistry.** Lectures. Second term. Credit one hour. Prerequisite course 305. F, 11. Place to be arranged. Professor ORNDORFF.

The stereochemistry of the compounds of carbon and nitrogen. The necessity of considering the space relations of the atoms in certain classes of isomers is shown and the close agreement of facts and theory is brought out.

340. **Methods of Organic Analysis.** Laboratory practice. Throughout the year. Credit two to six hours a term. Prerequisite courses 305 and 310. Hours to be arranged. The laboratory is open daily. Professor ORNDORFF and Mr. CORNWELL.

Practice in the qualitative and quantitative analyses of commercial organic products such as alcohols, ethers, organic acids, glycerin, formalin, acetates, coal tar distillates, petroleum products, soaps, acetanilid, etc.

375. **Elementary Organic Chemistry.** Lectures, written reviews, and laboratory practice. First term. Credit five to six hours; lectures and written reviews only, four hours. Students who are preparing for the study of medicine must take the whole six hours. Prerequisite courses 210 and 225 (or 205 and 220). Open to those who are taking course 220. Lectures and written reviews, M W F, 12, *Franklin 10;* S 12, *Sibley Dome*. Laboratory practice and oral reviews. M T, 2–5. Mr. CORNWELL and assistants.

395. **Research for Seniors.** Throughout the year. See page 5. Professor ORNDORFF.

PHYSICAL CHEMISTRY

405. **Introductory Physical Chemistry.** Lectures. Throughout the year. Credit three hours. Prerequisite course 305 or 375 and Physics 2 and 8c. M W F, 9. *Rockefeller B.* Assistant Professor BRIGGS and assistants.

A systematic presentation of modern chemical theory in which special attention is paid to the following topics: Gases, liquids, and solids; the theory of solution; reaction velocity, catalysis, and chemical equilibrium; the Phase Rule; colloid chemistry; thermochemistry; photochemistry, and elementary electrochemistry.

It is advisable, but not obligatory, that course 410 accompany this course.

410. **Introductory Physical Chemistry.** Laboratory practice. Throughout the year. Credit three hours a term. Open only to those who have taken or are taking course 405. Laboratory sections, M T, 2–4:30; Th F, 2–4:30; S, 8–1. Assistant Professor BRIGGS and assistants.

Qualitative and quantitative experiments illustrating the principles of physical chemistry and including practice in performing physical chemical measurements. An important feature of this course is the presentation of detailed reports based upon the data obtained in the laboratory.

[415. **Advanced Physical Chemistry.** Lectures. Throughout the year. Credit two hours a term. Prerequisite course 405. Professor BANCROFT.

An exposition of the law of mass action in its application to chemical equilibrium and reaction velocities.] Not given in 1921–22.

430. **Applied Colloid Chemistry.** Lectures. Throughout the year. Credit two hours a term. T Th, 10. *Morse 119.* Professor BANCROFT.

The theory of colloid chemistry and its application in the arts. Open to candidates for the degree of Bachelor of Chemistry if they have taken course 405; to others only by special permission.

450. **Applied Electrochemistry.** Lectures. Throughout the year. Credit two hours a term. Prerequisite course 405. W F, 12. *Morse 119.* Assistant Professor BRIGGS and assistant.

The theory of electrolysis and electromotive force; electrolytic extraction and refining of metals; electrolytic manufacture of organic and inorganic compounds; theory and practice of storage cells; preparation of compounds in the electric furnace.

455. **Applied Electrochemistry.** Laboratory practice. Throughout the year. Credit two hours a term. Open to those who have taken courses 405 and 410 and have taken or are taking course 450. Hours to be arranged. Assistant Professor BRIGGS and assistant.

Qualitative and quantitative study of electrolysis; determination of electrical conductivity; potentiometric measurements; hydrogen ion concentration; determination of current and energy efficiencies in electrolytic and electrothermal work; electrolytic preparation of organic and inorganic compounds; tests of storage cells; preparation of compounds in the electric furnace; measurement of high temperatures.

460. **Theoretical Electrochemistry.** Lectures. Throughout the year. Credit two hours a term. Prerequisite course 405. T Th, 11. *Morse C.* Professor BANCROFT.

The historical development of the subject with special reference to the theory of the voltaic cell. For advanced students in chemistry or physics.

465. **Advanced Physical Chemistry.** Laboratory practice. Either term or throughout the year. Credit not to exceed six hours a term. Prerequisite courses determined in each case by the professor in charge. Hours and work to be arranged. Professor BANCROFT, Assistant Professor BRIGGS, and assistants.

Students may elect in mass law, reaction velocity, or efficiency measurements with special reference to course 415; in photochemistry, photography, or colloid chemistry with special reference to course 430; in conductivity or electrometric determinations with special reference to course 460; in electrolytic or electric furnace products with special reference to course 450; in the application of physical chemical methods to organic chemistry.

495. **Research for Seniors.** Throughout the year. See page 5. Professor BANCROFT and Assistant Professor BRIGGS.

OPTICAL CHEMISTRY

505. **Introductory Chemical Spectroscopy.** Lectures, written reviews, and laboratory practice. Repeated in the second term. Credit three hours. Prerequisite courses 210 and 225 (or 205 and 220), and Physics 2. Open only to those who have taken or are taking Physics 8c. Lectures and written reviews, T Th, 8. *Morse 119.* Laboratory sections, M T W Th F, 2–4:30; S, 8–10:30. Mr. PAPISH and assistants.

The construction and use in chemical analysis of the spectroscope, polariscope, refractometer, colorimeter, and nephelometer. The laboratory instruction is devoted to the training of the student in the use of these instruments in the solving of chemical problems.

510. **Advanced Chemical Spectroscopy.** Laboratory practice. First term. Credit two or more hours. Prerequisite course 505. Hours to be arranged. Mr. PAPISH and assistants.

The study of arc, spark, and absorption spectra and the application of spectroscopic methods to the identification of dyestuffs. Practice in one or more of the subjects mentioned may be selected by the student.

515. **Advanced Chemical Polarimetry and Refractometry.** Laboratory practice. Second term. Credit two or more hours. Prerequisite course 505. Hours to be arranged. Mr. PAPISH and assistant.

The practical application of polarimeters, refractometers, colorimeters, and nephelometers to the solution of problems arising in the chemical laboratory, special emphasis being laid upon the advantages of different types of instruments.

520. **Spectrographic Methods.** Laboratory practice. Either term. Credit one or more hours. Prerequisite course 505. Hours to be arranged. Mr. PAPISH.

The application of photographic methods to arc, spark, and absorption spectroscopy. Practice is also given in the applications of ultra-violet spectroscopy in chemical analysis, and in the recognition of lines and the reading of wavelengths on photographs of spectra.

530. **Introductory Chemical Microscopy.** Lecture and laboratory practice. Repeated second term. Credit two hours. Prerequisite courses 210 and 225 (or 205 and 220). Lecture, M, 12. *Morse 119.* Laboratory sections, M T, 2–4; T Th, 10–12; Th, 2–4, F, 10–12. First term, Mr. MASON and assistants. Second term, Professor CHAMOT and assistants.

The use of the microscope and its accessories; microscopic methods as applied to chemical investigations. The examination of crystalline compounds, recogni-

tion of textile and paper-making fibers, etc. The application of microscopic methods to quantitative analysis. The methods of microscopic investigation useful in metallurgical and chemical industries.

535. **Advanced Chemical Microscopy.** Laboratory practice. Second term. Credit two or more hours. Prerequisite course 530. Laboratory sections, M T, 2–4:30; T Th, 10–1; Th, 2–4:30, F, 10–1. Professor CHAMOT and assistants.

Practice in the examination and analysis of inorganic substances containing the more common elements with special reference to rapid qualitative methods and to the analysis of minute amounts of material.

[540. **Advanced Chemical Microscopy.** Laboratory practice. Either term. Credit two hours. Prerequisite course 530. Laboratory hours to be arranged. Professor CHAMOT and assistants.

Microscopic chemical qualitative analysis as applied to the study and analysis of organic compounds.] Not given in 1921–22.

545. **Microscopy of Commercial Alloys.** Laboratory practice. Second term. Credit two hours. Prerequisite course 530. Laboratory sections to be arranged. Professor CHAMOT and assistants.

An introduction to the methods employed in microscopic examination of metals, alloys, and other metallurgical products. Practice in grinding, polishing, and etching specimens for miscroscopic study. Metallographic microscopes and their use.

This course may be extended to include other materials of construction.

[550. **Microscopy of Foods and Beverages.** Laboratory practice. First term. Credit two hours. Prerequisite course 530. Laboratory sections to be arranged. Professor CHAMOT and assistants.

The application of microscopic methods to the examination of foods and beverages for the purpose of ascertaining their purity and for the detection of deteriorations, adulterations, and admixtures.] Not given in 1921–22.

595. **Research for Seniors.** Throughout the year. See page 5. Professor CHAMOT.

SANITARY CHEMISTRY

605. **Introductory Sanitary Chemistry (Foods).** Lectures. First term. Credit two hours. Prerequisite course 305 or 375. T Th, 12. *Morse 119.* Mr. GEORGIA and assistant.

Methods employed in the analysis of foods, beverages, and food accessories with special reference to the detection and determination of adulteration and spoilage; the relation of the chemical composition of materials used in the household to the public health.

It is advisable, but not obligatory, that course 610 accompany this course.

610. **Introductory Sanitary Chemistry (Foods).** Laboratory practice. First term. Credit two hours. Open to those who have taken or are taking course 605. Laboratory sections, M T, 2–4:30; Th F, 2–4:30. Mr. GEORGIA and assistant.

Laboratory exercises designed to illustrate the material presented in course 605.

615. **Introductory Sanitary Chemistry (Water).** Lectures. Second term. Credit two hours. Prerequisite course 305 or 375. T Th, 12. *Morse 119.* Mr. GEORGIA and assistant.

Sources of potable water; pollution of water supplies; physical, chemical, bacteriological, and microscopical examination of water for household and municipal purposes; examination of sewage, and sewage effluents; methods and control of water purification, water softening, sewage disposal, and garbage disposal. Interpretation of analytical results and the preparation of sanitary surveys.

It is advisable but not obligatory that course 620 accompany this course.

620. **Introductory Sanitary Chemistry (Water).** Laboratory practice. Second term. Credit two hours. Open to those who have had or are taking course 615. Laboratory sections, M T, 2–4:30; Th F, 2–4:30. Mr. GEORGIA and assistant.

Laboratory exercises designed to illustrate the material presented in course 615.

[630. **Advanced Sanitary Chemistry.** Lectures. First term. Credit two hours. Prerequisite course 615. T Th, 9. Mr. GEORGIA.

The course is designed to meet the needs of those students who desire to specialize in the field of water purification and sewage disposal.

Laboratory work to accompany this course may be elected under course 635.] Not given in 1921–22.

635. **Advanced Sanitary Chemistry.** Laboratory practice. Either term. Credit two or more hours. Prerequisite course 610 or 620. Hours to be arranged. Mr. GEORGIA and assistant.

Students who have had adequate preparation may elect work in any branch of sanitary chemistry, or in the examination of water for special industrial purposes.

640. **Special Topics in Sanitary Chemistry.** Lectures. Second term. Credit two hours. Prerequisite course 305 or 375.

A discussion of popular questions in this field. The topics considered in this course will be changed from year to year.

The lectures for 1921–22 will deal with disinfectants and closely associated substances.

650. **Chemistry of Foods and Food Products.** Lectures. Second term. Credit two hours. Prerequisite course 305 or 375. T Th, 11. Place to be arranged. Professor CAVANAUGH.

The chemical composition, chemical properties, and methods of manufacture of the principal foods and food products. Methods for the determination of the normal constituents of foods. Special attention is given to the chemistry of milk and milk products, cereal products, sugars, fruits, and fruit products.

A two-hour laboratory course designed to accompany this lecture course is offered. See Announcement of the College of Agriculture, Agricultural Chemistry, course 107.

695. **Research for Seniors.** Throughout the year. See page 5. Mr. GEORGIA.

INDUSTRIAL CHEMISTRY

705. **Industrial Chemistry.** Lectures. Throughout the year. Credit three hours a term. Prerequisite course 405. Seniors who are taking course 405 will be admitted to this course. M W F, 10. *Morse 119.* Professor RHODES.

A discussion of various typical processes of chemical manufacturing from the standpoint of: (a) available materials, their properties and limitations; (b) standard forms of apparatus used in chemical manufacturing; (c) properties and specifications of commercial chemicals; (d) computation of costs and profits in chemical manufacturing.

710. **Industrial Chemistry.** Laboratory practice. Either term. Credit two, three, or four hours. Prerequisite course 405. Professor RHODES and assistant.

The study in the laboratory of the processes and materials that are used in the chemical industries.

715. **Selected Topics in Industrial Chemistry.** Lectures. First term. Credit two hours. Open to students who have completed or are taking course 705. M W, 11. *Morse B.* Professor RHODES.

The chemistry of coal, the fuel gases, and the refining of petroleum. Particular stress is laid upon the chemistry of the carbonization of coal, and upon the applications of physical chemistry to the reactions involved in the manufacture and the purification of the fuel gases.

720. **Coal Tar Products.** Lectures. Second term. Credit two hours. Open to students who have completed or are taking course 705. M W, 11. *Morse B.* Professor RHODES.

The distillation of coal-tar; the manufacture of road tars, pitches, oils, and naphthas; and the preparation of refined naphthas, tar acids, naphthalene, toluene, and other refined coal-tar products.

775. **Engineering Chemistry.** Lectures. Repeated in second term. Credit two hours. Prerequisite course 101. M W, 8. *Goldwin Smith A.* Professor RHODES.

Chemistry in its relations to engineering.

795. **Research for Seniors.** Throughout the year. See page 5. Professor RHODES.

AGRICULTURAL CHEMISTRY

805. **Agricultural Chemistry. General Course.** Lectures and recitation. Second term. Credit four hours. Prerequisite course 101. It is recommended, but not required that this course be preceded by Organic Chemistry. M W F, 11. *Rockefeller B.* One recitation, to be arranged. Professor CAVANAUGH.

The relation of chemistry to agriculture, and an introduction to the study of the composition and chemical properties of plants, fertilizers, feedstuffs, insecticides, and fungicides.

A two-hour laboratory course, designed to accompany this lecture course, is offered. See Announcement of the College of Agriculture, Agricultural Chemistry course 86.

810. **Chemistry of Fertilizers and Insecticides.** Lectures. First term. Credit three hours. Prerequisite course 805. It is recommended but not required that this course be preceded by course 86 and accompanied by course 88. M W F, 10. *Morse—.* Professor CAVANAUGH.

A more detailed study of the chemistry of fertilizers and insecticides than is covered in course 805. The preparation, manufacture, and properties of old and new fertilizers and insecticides. Methods of sampling and analysis used by the Association of Official Agricultural Chemists.

(*For courses 86 and 88, see the Announcement of the College of Agriculture.*)

815. **Chemistry of Insecticides and Fungicides, Advanced Laboratory Course.** Either term. Credit two or more hours. Prerequisite courses 810 and 88. Hours to be arranged. Professor CAVANAUGH.

895. **Research for Seniors.** Throughout the year. See page 5. Professor CAVANAUGH.

SEMINARY

905. **Seminary.** Credit one hour. For seniors who are candidates for the degree of Bachelor of Chemistry. *Morse 119.*

CORNELL UNIVERSITY OFFICIAL PUBLICATIONS

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